TRANSLATION (BM-162PCT):

LOCK SYSTEM FOR A DOOR, HATCH, ETC., ESPECIALLY FOR VEHICLES

The invention pertains to a lock system of the type cited in the introductory clause of Claim 1. This system comprises an access authorization device, which consists of a stationary part in the vehicle and a mobile part carried by the authorized person. A specific function in the lock or in the vehicle is triggered upon the initiation and successful completion of a data exchange between the mobile part and the stationary part.

It is known that a capacitative sensor in the handle can be used to initiate this data exchange (DE 196 17 038 C2). This sensor creates a uniform field in the area of the handle and responds when a human hand approaches the field. Then the previously mentioned data exchange begins; and, upon completion of this exchange, the function by which the lock is switched to its release position is triggered. This lock system offers the advantage that the lock is switched to its release position even before the handle is actuated. This means that the door can be opened quickly. A push button, which must be actuated to switch

the lock back into its locking position, is mounted on the outside of the handle. An additional manual operation is thus required, which is burdensome. The vehicle owner must learn how to perform this additional operation. The switching of the lock in the one direction via the capacitative sensor and in the other direction via the pus button requires the use of two different systems, which must be coordinated with each other. In addition, each of the two systems requires its own system-specific components. This occupies space in the area of the handle, space which is already in short supply.

It is already known (DE 100 51 055 A1) that two electrodes for two capacitative sensors can be installed in the handle with shielding between them. The two electrodes generate two spatially separate electric fields. The one electrode generates an inner field in the intermediate space between the handle and the vehicle. When a human hand arrives in the area of this inner field, the lock is switched to its release position. The other electrode generates an outer field between the handle and the area surrounding the vehicle. When the authorized person, i.e., the person who is carrying the mobile part belonging to the vehicle, arrives within a defined minimum distance from the

handle, the lock is switched to its locking position. In one case, the two electrodes are mounted on the same side of a common circuit board, offset from each other in the vertical direction. This means that a large amount of space is required to install the electrodes in the handle. In another case, the two electrodes are realized on a multilayer circuit board. The production of such multilayer circuit boards, however, is expensive and time-consuming.

The invention is based on the task of developing a reliable lock system of the type cited in the introductory clause of Claim 1, which is compact and which can be produced easily and inexpensively. This is achieved according to the invention by the features indicated in Claim 1, to which the following special meaning attaches.

The hinges make it possible to produce the individual circuit board parts easily, because they are in the flat, spread-out position during the production process. In this phase, the circuit board parts extend over a large area, as a result of which the two electrodes and the shielding can be produced without interference from each other. These components can therefore be manufactured inexpensively and

conveniently. For use in the handle, however, the circuit board parts are folded over onto each other and thus made into a compact, collapsed unit. A folded-up, three-layer product with a small base surface is obtained. The space-saving, compact folded product thus obtained can be easily installed in the limited space available in the interior of the handle. The design also allows fast and easy installation.

It is especially advantageous according to Claim 4 for the circuit board parts of the folded product to be designed as a one-piece unit in the form of three adjacent sections of a single overall board. These three sections are separated from each other by film hinges. Then at least one conductive trace, as recommended in Claim 5, can cross the area of the film hinge and thus connect two or all three of the adjacent sections of the folded product electrically together.

Additional measures and advantages of the invention can be derived from the subclaims, from the following description, and from the drawings. The drawings show an exemplary embodiment of the invention:

-- Figure 1 shows a schematic plan view of a vehicle, into which an inventive lock system has been integrated;

-- Figure 2 shows an exploded, perspective view of a handle belonging to a door of the vehicle of Figure 1 before a preassembled structural unit, also shown in perspective, is installed in it;

-- Figure 3 shows, on a magnified scale, a cross section through part of the door shown in Figure 1, along the cross-sectional line III-III indicated in that figure, where only the components lying in the cross-sectional plane are illustrated;

-- Figure 4 shows the structural unit, which is still outside the handle in Figure 2, in a previous stage of fabrication, namely, a plan view of a preliminary product, where three circuit board parts connected to each other in a hinge-like manner are in their flat, spread-out state;

-- Figure 5 shows a fabrication stage following that of Figure 4, namely, a plan view of the finished product, which is obtained by folding the preliminary product of Figure 4 into a compact unit in which the circuit board parts are folded onto each other;

-- Figure 6 shows, on a magnified scale, a cross section through the structural unit along the cross-sectional line VI-VI of Figure 5;

-- Figure 7 shows, on a magnified scale, a plan view of the edge area of the unfolded structural unit indicated at VII in Figure 4;

-- Figure 8 shows a longitudinal cross section through the preliminary product of Figure 7 along the cross-sectional line VIII-VIII in that figure; and

-- Figure 9, also on a magnified scale, shows a partial cross section through the finished structural unit of Figure 5 along the cross-sectional line IX-IX in that figure.

The lock system according to the invention not only saves a great deal of space but also makes it possible for the authorized user to gain access to the vehicle 10 in an especially quick and convenient manner while also reliably preventing unauthorized third parties from doing the same. In the exemplary embodiment shown, access to the vehicle is possible through two doors 11, 12, through a hatch 13, and through a hood 14. All these movable parts 11-14 are held in their locked positions on the body by the same or different locks 15. The locks can be switched jointly between their locking positions and their release positions by means of a known central control unit. It is sufficient to explain this in

greater detail on the basis of one of the handles 20, belonging to one of the doors 11.

As Figure 2 shows, the handle can have a two-part design, consisting, for example, of a base shell 21 and a cover shell 22, between which a space 23 is present to hold a separate electrical component 30. In the present case, the handle 20 is designed as a so-called ``pull'' handle, which has a pivot bearing 25 at one end and a shaft 26 at the other end, the shaft acting via intermediate elements on the associated lock 15 in the door 11. The handle 20 is advisably located near a grip well 16 in the outer panel of the door 11, so that an intermediate space 17 is created there between the handle 20 and the outer door panel of the vehicle 10.

Figure 4 shows the preliminary fabrication stage 30' of the structural unit 30, in which the unit is in the flat initial state, whereas Figure 5 shows the finished state. This unit comprises a flexible leaf 35, functioning as the overall circuit board, on the flat side 36 of which, as can be see in Figures 7 and 8, three conductive areas 41, 42, 43 and three conductive traces 44, 45, 46 are located. Two linear film hinges 37, 38, which are parallel to each other, extend down the length of the

leaf 35; these hinges divide the overall circuit board into three strip-like sections 31, 32, 33. The hinges 37, 38 make it possible for the individual sections 31, 32, 33 to be folded over twice 19, 29 to form a three-layer folded product 40, as shown in Figure 6.

The finished folded product 40 can be held together by snap connectors 27, 28. In the present case, the two cooperating halves of these connectors consist of a flexible hook 27, which forms a single unit with the overall circuit board, and a hole 28 in the leaf 35. After the folding operations 19, 29, the hook 27 passes through the hole 28 and automatically grips the outer edge area of the hole 28. Several of these snap connectors 27, 28 are distributed along the longitudinal edges of the sections 32, 33.

As can be seen from the flat preliminary product 30', there is also a fourth section 34. This section is designed as an extension of the third section 33 and is therefore outside the actual folded zone characterized by the number 39. This fourth section 34 is formed from the same leaf material 35 and also has conductive traces 47. The difference, however, is that various electrical components 48, which are part of a complex control

system for the inventive lock, are mounted on this extension and are connected to the conductive traces 47. The previously mentioned conductive traces 44, 45, 46, which lead to the various conductive areas 41, 42, 43, therefore proceed from the electrical components 48 mounted on the extended section 34. It is worth mentioning that the conductive traces 44, 45 leading to the neighboring sections 31, 32 continue without interruption across the area of the film hinges 37, 38 and therefore ensure contact between the conductive surfaces 42, 41 present there and the corresponding components 48 on the extension 34. As can be seen at 49, the three conductive areas 41, 42, 43 are each formed by intersecting conductive traces, which form a grid 49 on each of the sections 31, 32, 33. The conductive traces can cover the entire surface and can have any desired geometry.

Each of the conductive areas 41-43 has a different function to fulfill. After the finished unit 30 has been installed in the handle 20 and connected to the required components in the vehicle 10, these areas form the electrodes 51, 52 of two capacitative sensors 61, 62, each with its own manner of operation, as will be explained in greater detail on the basis of Figures 3 and 6. The electrical cable 58 projecting from the

unit 30 in Figures 2 and 5 and the contact parts 59 are used for this purpose. The one electrode 51 produces a first electrical field 50 according to Figure 3 extending toward the body of the vehicle 10; this field is created in the previously mentioned intermediate space 17 between the handle 20 and the well 16. This field 50, as previously mentioned, will therefore be called in brief the ``inner field'', and this electrode 51 will be called the ``inner electrode''. This inner electrode 51 is shielded from the other electrode 52 by a third conductive surface 43, which is grounded, and which, in the folded state 40 of Figure 6, is located between the other two electrodes. The third surface therefore functions as the shielding 53.

When voltage is applied, the other electrode 52 generates a second electrical field 60, according to Figure 3, directed toward the outer environment of the vehicle. Because this field 60, from the perspective of the handle 20, is directed outward, it will be called the ``outer field'', as previously mentioned. It is independent of the inner field 50. The electrode 62 used to generate this outer field 60 will therefore be called correspondingly the ``outer electrode''. The way in which the inner and outer fields 50, 60 work can be explained best on the

basis of the schematic diagram of Figure 1.

There is in the vehicle 10 at least one control unit 55, which is fed by a power source such as the vehicle's battery 54. The control unit 55 is connected via control lines 56 and supply lines 57 to the previously mentioned electrical cable 58 of the unit 30. The inventive lock system also comprises an electronic access authorization system, which includes a stationary part, installed permanently in the vehicle. Some of the components of the stationary part are integrated into the control unit 55. The rest of the stationary part consists of one or more transmitting and receiving units 63, which are installed at various suitable points in the vehicle.

The mobile part 64, in the form of a ``check card'' as indicated schematically in Figure 1, is carried by the authorized person. Transmitting and receiving units, a memory circuit, power sources, and control components (not shown) are integrated into this card in a manner known in and of itself. When the authorized person comes within a certain suitable distance of the vehicle 10, the stationary part 55 can initiate a mono- or multi-directional data exchange 65 by electromagnetic means with the mobile part 64 of the access authorization

device. The inner field 50 and the outer field 60 are generated at the handle 20 by this time at the latest. When the authorized person now puts his/her hand behind the handle 20 of Figure 3, the inner electrical field 50 present there is altered. This is detected by the associated first sensor 61, which then switches the lock 15 and, in the case of a central control unit, additional locks or all of the locks of the vehicle 10 to their release position. The lock 15 has already been unlocked by the time the authorized person has gripped the handle 20. Since the door 11 or 12 has now been released, pulling the handle 20 outward has the effect of opening the door. Because the function of this first, lock-releasing sensor 61 is to switch the lock 16 the position in which the door can be opened, it will be called the ``opening sensor'' in the following.

When the authorized person leaves the vehicle 10, he or she can, if in possession of the mobile part 64, cause the locks 15 to lock themselves automatically. To close the opened door, the hand will approach the handle 20 from the outside and thus arrive in the area of the outer field 60. The inward-moving hand causes a change in the capacitance, which is detected by

the second capacitative sensor 62. In this case, the control unit will switch the lock 15 or all of the locks into their locking position. After the authorized person carrying the mobile part 64 has left the vehicle 10 and shut the doors 11, 12, he/she can thus lock them so that they cannot be opened by unauthorized persons. The second sensor 62, which is operating in this case, can therefore be called in an analogous manner the ``locking sensor''.

It would also be possible for the control system to generate the inner field 50 and the outer field 60 only in an alternating manner. When, for example, the lock 15 is in its locking position, there is no need for the outer field 60. It is sufficient for the system to generate only the inner field 50 and for only the opening sensor 61 to be active. When, in contrast, the lock 15 is in its release position, there is no need for the inner field 50. It is then sufficient for the system to generate only the outer field 60 and for only the locking sensor 62 to be in operation.

If the technique of generating the two fields 50, 60 in alternation as described above is used, there is also no longer any need for the intermediate shielding 53. In this case, it

would then be sufficient for the folded product 30 to have only two layers; that is, the third section 33 could be omitted. The previously described extension section 34 would then be positioned on one of the two remaining sections 31, 32. The inner field 50 could then extend over certain areas of the outer field 60 and vice versa.

If the handle 20 does not consist of two components 21, 22, which are made separately and then attached to each other, but rather of a single unit with one or more components made by means of the injection molding process, for example, then the unit 30 can be introduced as an insert into the empty injection mold and surrounded on all sides by the molding compound. Only the electrical cable 58 and the contact parts 59 would project to the outside.

Finally, it would also be possible to integrate the transmitting and receiving units 63 belonging to the stationary part of the access authorization device into the handle as well. They could then also be a component of the previously described unit 30.

The flexible leaf 35 for making the previously described folded product 40 and the unit 30 also obviously makes the

finished unit 30 flexible. If the handle 20 has the curvature 66 in the mounting area 23 indicated in Figure 2 in dash-dot line by way of example, then, when the unit 30 is laid in place, it can be bent in the direction of the arrows 67 of Figure 2 without impairment to its function. Because the folded unit 30 is very thin and is made of flexible plastic, it can be conveniently bent 67. As a result of this flexibility, the unit 30 can be adapted to handles of any profile 66 and can extend over much of the length of the handle 20. This promotes the generation of large and effective inner and outer fields 50, 60 and allows optimal utilization of the space available in the handle 20.

List of Reference Numbers

10 vehicle

11 first door of 10

12 second door of 10

13 hatch of 10

14 hood of 10

15 lock at 11 or 12

16 well at 20

17 intermediate space

19 first fold, folding movement

20 handle

21 base shell of 20

22 cover shell of 20

23 mounting space in 20

25 pivot bearing of 20

26 shaft, working element on 20

27 first half of a snap connection, hook

28 second half of a snap connection, hole

29 second fold, folding movement

30 electrical unit

30' flat preliminary product of 30

31 first section of 35

32 second section of 35

33 third section of 35

34 extension of 33, fourth section of 35

35 overall circuit board, flexible leaf

36 a flat side of 35

37 first film hinge between 31 and 32

38 second film hinge between 31 and 33

39 fold zone of 30, 30' (Figures 4, 5)

40 folded product (Figures 5, 6)

41 first conductive area, on 31

42 second conductive area, on 32

43 third conductive area, on 33

44 second conductive trace, on 33, 32, 31

45 first conductive trace on 33, 31

46 third conductive trace, on 33

47 conductive trace on 34

48 electrical component on 34

49 intersection conductive traces, grid on 41-43

50 first electrical field, inner field (Figure 3)

51 first electrode, inner electrode, produced by 41

52 second electrode, outer electrode, produced by 42

53 shielding, produced by 43

54 power source, vehicle battery

55 control unit, stationary part of the access authorization device (Figure 1)

56 electrical control line of 55

57 electrical supply line of 55

58 electrical cable projecting from 30 (Figures 2, 5)

59 electrical contact part on 58 (Figures 2, 5)

60 second electrical field, outer field (Figure 3)

61 first capacitative sensor, opening sensor

62 second capacitative sensor, locking sensor

63 transmitting and receiving unit of the stationary part of the access authorization system

64 mobile part of the access authorization system, check card

65 data exchange between 63 and 64 (Figure 1)

66 curvature of 20 (Figure 2)

67 bending movement of 30 (Figure 2)